भारतीय मानक
Indian Standard

IS 8360 : 2022
[*Amalgamating* IS 8360 (Parts 1 to 3)]

जल आपूर्ति के लिए संविरंचित पॉलीइथाईलिन फिटिंग — विशिष्टि

(पहला पुनरीक्षण)

Fabricated Polyethylene Fittings for Water Supply — Specification

(First Revision)

ICS 23.040.45, 91.140.60, 93.025

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

June 2022 **Price Group 6**

Plastic Piping System Sectional Committee, CED 50

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastic Piping System Sectional Committee had been approved by the Civil Engineering Division Council.

The fabricated PE fittings are used for connection, by welding process, to PE pipes covered by IS 4984 : 2016 'Polyethylene pipes for water supply — Specification (*fifth revision*)'.

Injection moulded/machined PE fittings are covered in IS 8008 : 2022 'Injection moulded/machined polyethylene fittings for water supply — Specification (*second revision*)'.

This standard was first published in 1977 in 3 parts as given below:

IS 8360 Specification for fabricated high density polyethylene (HDPE) fittings for potable water supplies:

Part 1 : 1977 General requirements

Part 2 : 1977 Specific requirements for 90° tees

Part 3 : 1977 Specific requirements for 90° bends

The Part 1 of the series dealt with the general requirements applicable to all fabricated PE fittings, and specific requirements of different type of fittings were covered in the other two parts of the Standard.

This revision of the standard has been brought out to align the requirements relating to dimensional requirements and sampling methodology as per the revised IS 4984 : 2016 'Polyethylene pipes for water supply — Specification (*fifth revision*)'. Further, in this revision of the standard, it has been decided to amalgamate all the parts for ease of reference, as also as per the corresponding International (ISO) Standard.

In this revision of the standard, the following major modifications have been incorporated:

a) As polyethylene fittings are designated by their minimum required strength (MRS), the earlier nomenclature of high density polyethylene fittings has been renamed as polyethylene fittings. Further, the standard now covers fittings for all water supplies including potable water supply. Accordingly, the title of the standard has been modified.

b) As per IS 4984, wall thicknesses have been specified based on standard dimension ratios (SDR).

c) Requirements for 45° tees (Y tee), 90° cross tees (4 way tee), reducing tees, 30° bends, 45° bends and 60° bends have been added.

d) 90° tees of sizes from 20 mm to 500 mm were covered, which have been now increased to cover up to sizes 2 500 mm;

e) 90° bends of sizes from 20 mm to 500 mm were covered, which have been now increased to cover up to sizes 2 500 mm; and

f) Performance derating factors for fabricated fittings have been added.

In respect of potential adverse effects caused by these fittings on the quality of water intended for human consumption, this standard provides no information as to whether the fittings may be used without any restrictions and applicable regulations (if any) concerning the use of these fittings are to be followed.

Regarding guidance for laying and jointing of polyethylene pipes, including storage and handling, a reference may be made to IS 7634 (Part 2) : 2012 'Plastics pipes selection, handling, storage and installation for potable water supplies — Code of practice: Part 2 Laying and jointing of polyethylene (PE) pipes (*first revision*)'.

The composition of the technical committee responsible for formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FABRICATED POLYETHYLENE FITTINGS FOR WATER SUPPLY — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard covers requirements for material, sizes, performance requirements, sampling and marking of all types of fabricated polyethylene (PE) fittings, intended for connection to PE pipes covered by IS 4984 for water supplies.

1.2 The fittings covered in this standard are intended to be used under the following conditions of water supplies:

a) A maximum operating pressure of 2.0 MPa (20 bar); and
b) An operating temperature of 27 °C as the reference temperature.

1.2.1 For applications operating at constant temperatures other than 27 °C and between the range 20 °C to 45 °C, maximum allowable operating pressure shall be calculated in accordance with **1.4**, Table 1 and Fig. 1 of IS 4984.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
4984 : 2016	Polyethylene pipes for water supply — Specification (*fifth revision*)
8008 : 2022	Injection moulded/machined polyethylene fittings for water supply — Specification (*second revision*)

3 TERMINOLOGY

For the purpose of this standard, the terminologies given in IS 4984 shall apply in addition to that given below.

3.1 Fabricated Fitting — Fitting produced from pipe conforming to IS 4984 using butt welded process.

4 MATERIAL

The pipes used for the fabrication of PE fittings for water supplies shall conform to IS 4984.

5 SIZES AND DESIGNATION OF FITTINGS

5.1 The nominal outside diameter of the fittings at the free ends, D, covered in this standard are 16, 20, 25, 32, 40, 50, 63, 75, 90, 110, 125, 140, 160, 180, 200, 225, 250, 280, 315, 355, 400, 450, 500, 560, 630, 710, 800, 900, 1 000, 1 200, 1 400, 1 600, 1 800, 2 000, 2 250 and 2 500 mm. All fittings shall be designated by their nominal outside diameters, d at the free ends and grade of material. In case of reducing tees, the designation shall include both nominal outside diameter at equal ends, d_1 and that at reduced end, d_2 as $d_1 \times d_2$ and grade of material. The outside diameters at the free end of the fittings shall correspond to the outside diameters of the pipes given in IS 4984.

5.2 The manufacturer shall be responsible for the design and the pressure rating (PN) of the fittings. The manufacturer shall be able to demonstrate conformity to the declared PN. The pressure rating as well as the applicable de-rating factor 'f' (*see* Table 3) shall be recorded. The minimum testing requirement to demonstrate the performance of the fitting design shall be as given in **8**.

6 VISUAL APPEARANCE

When viewed without magnification, the internal and external surface of the fitting shall be smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity to this standard. The weld line should not be excess than the normal butt welded bead so as to affect the performance of fitting.

7 DIMENSIONS OF FITTINGS

7.1 The mean outside diameters, d_{em}, and the corresponding minimum and maximum wall thicknesses of the fittings at the free ends for weld, when measured in accordance with **7.4.1.1** of IS 4984 shall be as given in Table 3 and Table 4 of IS 4984. The ovality should be rounded while welding the fabricated pipes to avoid mismatch.

7.2 The laying length and tolerances thereon for different types of fabricated fittings shall be in accordance with **7.2.1** and **7.2.2**.

7.2.1 *Fabricated Tees*

7.2.1.1 *45° tee, 90° tee and 90° cross*

A typical illustration of fabricated 45° tee, 90° tee and 90° cross are shown in Fig. 1. The laying length and tolerances thereon for fabricated 45° tee, 90° tee and 90° cross shall be as given in Table 1 read with Fig. 1. Nominal angle of fitting, α (*see* Fig. 1) shall be declared by the manufacturer. The tolerance on nominal angle of fitting shall be ± 2°.

Table 1 Dimensions for Laying Length of Fabricated Tees

(*Clause* 7.2.1)

All dimensions in millimetres.

Sl No.	Size	Laying Length, *Z*			Tolerance
		45° Tee	90° Tee	90° Cross	
(1)	(2)	(3)	(4)	(5)	(6)
i)	16	40	40	40	±2
ii)	20	50	50	50	±2
iii)	25	62.5	62.5	62.5	±2
iv)	32	80	80	80	±2
v)	40	100	100	100	±2
vi)	50	125	125	125	±2
vii)	63	94.5	94.5	94.5	±2
viii)	75	112.5	112.5	112.5	±4
ix)	90	135	135	135	±4
x)	110	165	165	165	±4
xi)	125	187.5	187.5	187.5	±4
xii)	140	210	210	210	±6
xiii)	160	240	240	240	±6
xiv)	180	270	270	270	±6
xv)	200	300	300	300	±6
xvi)	225	337.5	337.5	337.5	±8
xvii)	250	375	375	375	±8
xviii)	280	420	420	420	±8
xix)	315	472.5	472.5	472.5	±8
xx)	355	532.5	532.5	532.5	±10
xxi)	400	600	600	600	±10
xxii)	450	675	675	675	±10
xxiii)	500	750	750	750	±10
xxiv)	560	840	840	840	±15
xxv)	630	945	945	945	±15
xxvi)	710	1 065	1 065	1 065	±20
xxvii)	800	1 200	1 200	1 200	±20
xxviii)	900	1 350	1 350	1 350	±25
xxix)	1 000	1 500	1 500	1 500	±25
xxx)	1 200	1 800	1 800	1 800	±30
xxxi)	1 400	2 100	2 100	2 100	±40
xxxii)	1 600	2 400	2 400	2 400	±50
xxxiii)	1 800	2 700	2 700	2 700	±75
xxxiv)	2 000	3 000	3 000	3 000	±100
xxxv)	2 250	3 375	3 375	3 375	±200
xxxvi)	2 500	3 750	3 750	3 750	±200

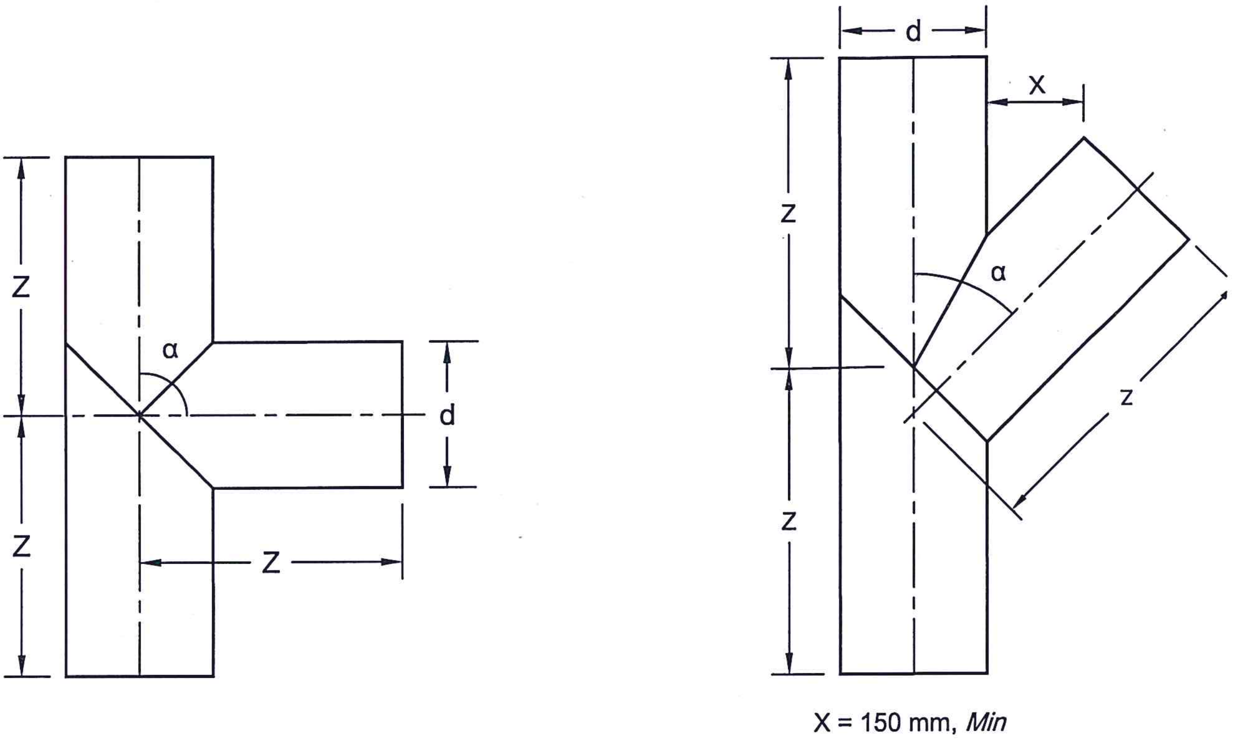
7.2.1.2 *Reducing tees*

Reducing tees can be fabricated by butt fusion welding of desired reducer as per IS 8008 to the desired arm of the tee. The whole assembly shall then be tested for performance requirement as per **8**.

7.2.2 *Fabricated Bends*

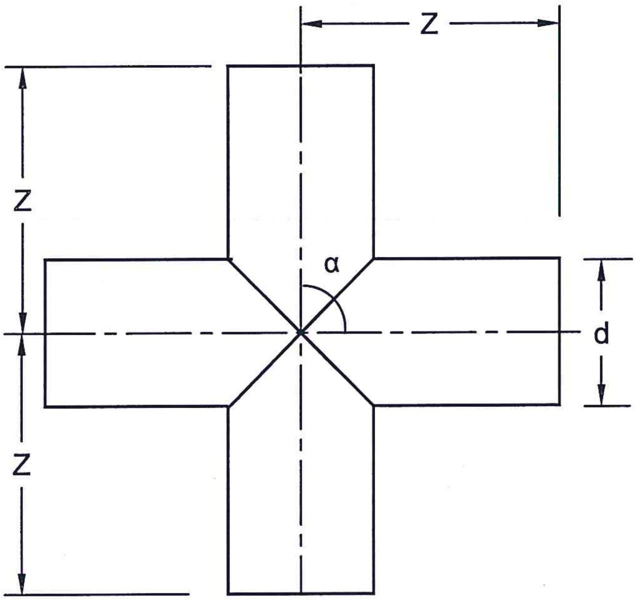
7.2.2.1 A typical illustration of fabricated 30°, 45°, 60° and 90° bends are shown in Fig. 2. The laying length and tolerances thereon for fabricated 30°, 45°, 60° and 90° bends shall be as given in Table 2 read with Fig. 2.

7.2.2.2 Nominal angle of fitting, α (*see* Fig. 2) shall be declared by the manufacturer. Tolerance on nominal angle of fitting, shall be ± 2°. Nominal bend radius, R shall be as declared by the manufacturer, for example, $1.5 \times d$, $2.0 \times d$, $3.0 \times d$, etc, where, d is the nominal outside diameter at free end of the fitting. Cut angle, β shall not be greater than 15°.



1A 90° TEE

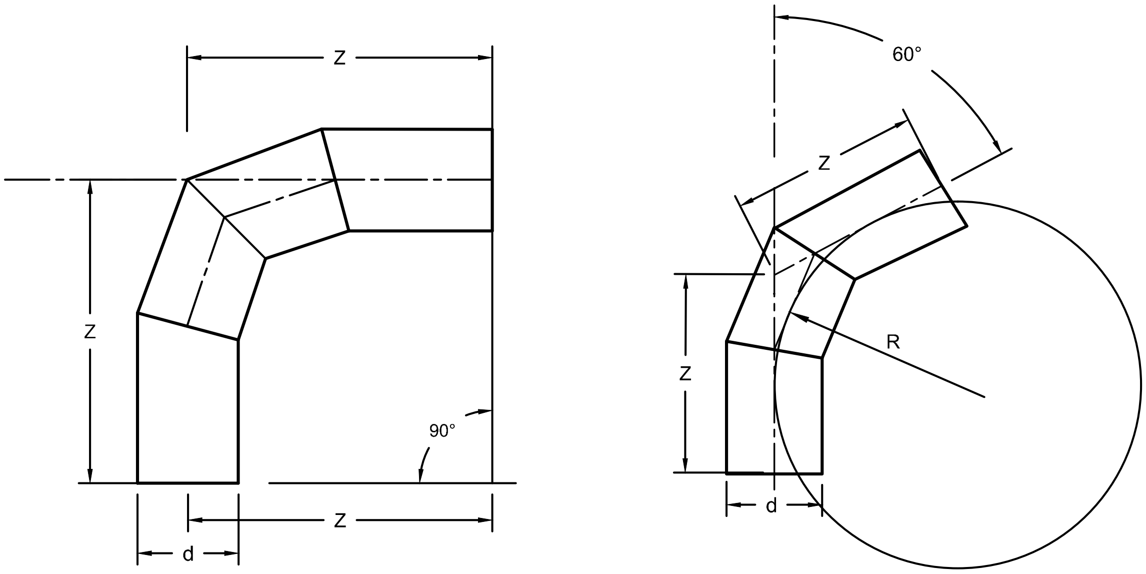
1B 45° TEE (Y TEE)



1C 90° CROSS (4 WAY TEE)

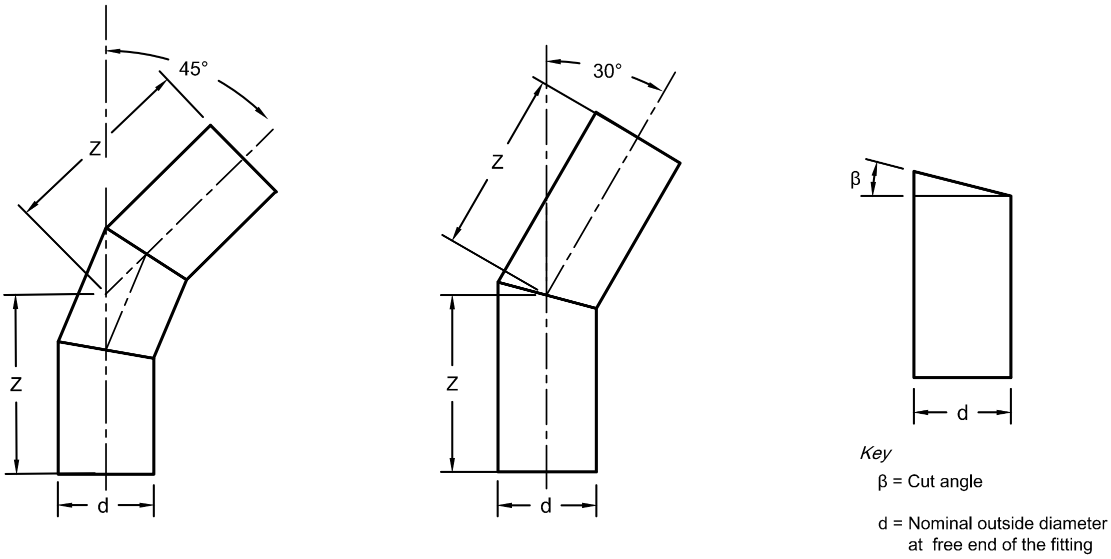
α = Nominal angle of fitting to be declared by the manufacturer.

FIG. 1 TYPICAL ILLUSTRATION OF FABRICATED TEES



2A 90° BEND

2B 60° BEND



Key

β = Cut angle

d = Nominal outside diameter at free end of the fitting

2C 45° BEND

2D 30° BEND

2E CUT ANGLE

FIG. 2 TYPICAL ILLUSTRATION OF FABRICATED BENDS

Table 2 Dimensions for Laying Length of Fabricated 30°, 45°, 60° and 90° Bends

(*Clause* 7.2.2)

All dimensions in millimetres.

Sl No.	**Size, d**	**Minimum Laying Length, Z**				**Tolerance**
		30° Bend	45° Bend	60° Bend	90° Bend	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	16	202	192	176	130	± 3
ii)	20	202	192	176	130	± 3
iii)	25	205	197	182	137	± 3
iv)	32	211	205	191	148	± 3
v)	40	217	213	202	160	± 3
vi)	50	317	309	290	225	± 3
vii)	63	327	323	307	244	± 5
viii)	75	336	336	322	262	± 5
ix)	90	347	352	342	285	± 5
x)	110	362	373	368	315	± 5
xi)	125	373	389	387	337	± 5
xii)	140	385	405	406	360	± 8
xiii)	160	400	426	432	389	± 8
xiv)	180	415	447	458	419	± 8
xv)	200	430	468	484	449	± 8
xvi)	225	448	495	517	487	± 10
xvii)	250	654	692	699	624	± 10
xviii)	280	676	724	738	669	± 10
xix)	315	796	846	858	771	± 10
xx)	355	825	889	910	831	± 12
xxi)	400	859	937	968	899	± 12
xxii)	450	897	990	1 033	974	± 12
xxiii)	500	1 027	1 128	1 173	1 098	± 12
xxiv)	560	1 072	1 192	1 251	1 188	± 15
xxv)	630	1 125	1 266	1 342	1 293	± 15
xxvi)	710	1 184	1 351	1 445	1 413	± 30
xxvii)	800	1 252	1 446	1 562	1 547	± 30
xxviii)	900	1 420	1 638	1 767	1 747	± 30
xxix)	1 000	1 497	1 744	1 899	1 900	± 40
xxx)	1 200	1 647	1 957	2 159	2 200	± 50
xxxi)	1 400	2 076	2 424	2 643	2 650	± 50
xxxii)	1 600	2 227	2 637	2 904	2 951	± 60
xxxiii)	1 800	2 656	3 104	3 389	3 401	± 75
xxxiv)	2 000	2 806	3 317	3 649	3 701	± 100
xxxv)	2 250	3 181	3 754	4 123	4 176	± 150
xxxvi)	2 500	3 368	4 019	4 448	4 551	± 150

7.3 Derating of Pressure Rating for Fittings

The pressure rating of the fabricated fitting made out of pipe segments, PN_{fitting} shall be obtained by derating the nominal pressure rating of the pipe as below:

$$PN_{\text{fitting}} = f \times PN_{\text{pipe}}$$

where

f = Derating factor as per Table 3; and
PN_{pipe} = Nominal pressure of the pipe.

Table 3 Derating Factor

(*Clause* 7.3)

Sl No.	Type of Fabricated Fitting	De-rating Factor, *f*
(1)	(2)	(3)
i)	Tees	0.5
ii)	Bends	
	$\beta \leq 7.5°$	1
	$7.5° < \beta \leq 15°$	0.8
	Where, β is the cut angle	

8 PERFORMANCE REQUIREMENTS

8.1 Hydraulic Characteristics

A fitting duly welded on all sides to straight length of a pipe of pressure rating to which the fitting corresponds, when subjected to internal pressure creep rupture testing in accordance with the procedure given in Annex E of IS 4984, and test assembly as given in Table 4, shall show no signs of localized swelling, leakage or weeping and shall not burst during the prescribed test duration. The temperature, duration of test and stresses for the test shall conform to the requirements given in Table 5.

Table 4 Length of Pipe for Welding Test

(*Clause* 8.1)

All dimensions in millimetres.

Sl No.	Pipe Outside Diameter	Length of Pipe Section
(1)	(2)	(3)
i)	Up to 75	200
ii)	90 to 225	300
iii)	250 or more	500

8.2 Tensile Strength for Butt-Fusion

When tested in accordance with Annex G of IS 4984, the test specimen prepared by punching/machining from butt fusion sample preferably 110 mm dia and SDR 11 shall show ductile failure. If the sample shows brittle failure the test may be considered as a failure. The test is to be conducted to judge the strength of the weld. Hence, a pipe section may be welded on the same parameter as that of fitting for preparing the test specimen as it may not be possible to prepare straight joint sample from fitting itself, like in case of bend. However, wherever possible, straight sample should be drawn from fitting itself.

NOTE — If 110 mm and SDR 11 pipes/fittings are not being manufactured, test shall be carried out on the nearest, preferably higher size/SDR ratio being manufactured. If pipe/fitting sizes only below 90 mm are manufactured, the test is not required, however, in such cases, a test certificate from the raw material (resin) supplier for establishing conformity to the above requirement for 110 mm/SDR 11 pipe/fitting shall be provided.

9 SAMPLING, FREQUENCY OF TESTS AND CRITERIA FOR CONFORMITY

9.1 Type Tests

9.1.1 Type tests are intended to prove the suitability and performance of a new composition, a new compounding

Table 5 Hydraulic Characteristic Requirements of Fabricated Fittings

(*Clause* 8.1)

Sl No.	Test	Test Temperature °C	Test Duration h	Induced Hoop Stress MPa		
				PE63	PE80	PE100
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Acceptance test:					
	a) For sizes ≥ 630 mm	27	1	2 × rated pressure	2 × rated pressure	2 × rated pressure
	b) For sizes < 630 mm	27	100	$6.9 \times f$	$8.6 \times f$	$10.7 \times f$
ii)	Type test	80	165	$3.5 \times f$	$4.5 \times f$	$5.4 \times f$

NOTE — f is the de-rating factor related to the fitting to be tested (*see* Table 3).

or processing, technique, or a new design or size of joint or fitting. Even if no change is envisaged, type test shall be done at least once during the validity period as given for each of the type tests in **9.1.3**.

9.1.2 For all type tests for fittings sizes up to 560 mm, three samples of fittings of same size, same grade, same SDR and same pressure rating shall be selected at random from the regular production lot and shall be tested for compliance with the requirements of the type tests as given in Table 6.

Table 6 Type Tests

(*Clause* 9.1.2)

Sl No.	Description of Test	Sample Size	Requirement Clause
(1)	(2)	(3)	(3)
i)	Internal pressure creep rupture test (hydrostatic resistance test) at 80 °C for 165 h	3	**8.1**
ii)	Tensile strength for butt-fusion	3	**8.2**

9.1.3 If all the samples pass the requirements of the tests, the type of the fitting under consideration shall be considered eligible for type approval, which shall be normally valid for a period of two years. However, failure on the weld joint shall not be considered as a failure of the type test. In such a case, the test shall be repeated.

9.1.4 In case of any of the samples fails in the type test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number and subject them to the type test again. If in repeat test, no single failure occurs, the type of pipe under consideration shall be considered eligible for type approval. If any of the samples fails in repeat tests, the type of fitting shall not be approved. The manufacturer or the supplier may be asked to improve the design and resubmit the product for type approval.

9.1.5 At the end of the validity period or earlier the testing authority may call for fresh samples for type test for the purpose of type approval.

9.1.6 For fittings sizes 630 mm and above, the sampling and criteria for conformity for type tests shall be as agreed between the manufacturer and the purchaser.

9.2 Acceptance Tests

9.2.1 Acceptance tests are carried out on samples selected from a lot for the purpose of acceptance of the lot.

9.2.2 *Lot*

All fittings of the same size, same SDR, same grade, and fabricated essentially under similar conditions of manufacture shall constitute a lot. For ascertaining conformity of the lot to the requirements of this standard, samples for acceptance test shall be selected and tested for compliance as per Table 7. These fittings shall be selected at random from the lot and in order to ensure the randomness of selection, a random number table shall be used. For guidance and use of random number tables, IS 4905 may be referred. In the absence of a random number table, the following procedure may be adopted.

Starting from any fitting in the lot, count them as 1, 2, 3, 4, etc, up to r and so on, where r is the integral part of N/n, N being the number of fitting in the lot and n is the number of fittings in the samples. Every r^{th} fitting so counted shall be drawn so as to constitute the required sample size.

Table 7 Acceptance Tests

(*Clauses* 9.2.2 *and* 9.2.4)

Sl No.	Description of Test	Sample Size	Requirement Clause
(1)	(2)	(3)	(4)
i)	Visual and dimensional requirements	Table 8	**5**, **6** and **7**
ii)	Internal pressure creep rupture test (hydrostatic resistance test) at 27 °C for 1 h/100 h, as applicable	Table 9	**8.1**

9.2.3 *Visual and Dimensional Requirements for Fabricated PE Fittings*

For ascertaining conformity of the lot to the requirements of this standard, the number of samples shall be selected as per Table 8 and tested for compliance.

The number of fittings given for the first sample in col 4 of Table 8 shall be examined for dimensional and visual requirements given in **5**, **6** and **7**. Fittings failing to satisfy any of these requirements shall be considered as defective. The lot shall be deemed to have satisfied these requirements, if the number of defectives found in the first sample are less than or equal to the corresponding acceptance number given in col 6 of Table 8. The lot shall be deemed not to have met these requirements if the number of defectives found in the first sample is greater than or equal to the corresponding rejection numbers given in col 7 of Table 8. If, however, the number of defectives found in the first sample lies between the corresponding acceptance and rejection numbers given in col 6 and col 7 of Table 8, the second sample of the size given in col 4 of Table 8 shall be taken and examined for these requirements. The lot shall be considered to have satisfied these requirements, if the number of defectives found in the cumulative sample is less than or equal to the corresponding acceptance number given in col 6 of Table 8, otherwise not.

Table 8 Scale of Sampling for Visual and Dimensional Requirements

(*Clause* 9.2.3)

Sl No. (1)	No. of Fittings in the Lot (2)	Sample Number (3)	Sample Size (4)	Cumulative Sample Size (5)	Acceptance Number (6)	Rejection Number (7)
i)	Up to 150	First	13	13	0	2
		Second	13	26	1	2
ii)	151 to 280	First	20	20	0	3
		Second	20	40	3	4
iii)	281 to 500	First	32	32	1	4
		Second	32	64	4	5
iv)	501 to 1 200	First	50	50	2	5
		Second	50	100	6	7
v)	1 201 to 3 200	First	80	80	3	7
		Second	80	160	8	9
vi)	3 201 to 10 000	First	125	125	5	9
		Second	125	250	12	13
v)	10 001 to 35 000	First	200	200	7	11
		Second	200	400	18	19

9.2.4 *Conformity to Acceptance Tests other than Visual and Dimensional Characteristics*

9.2.4.1 *Fittings sizes up to 560 mm*

The lot having satisfied visual and dimensional requirements shall be tested for acceptance tests other than dimensional and visual characteristics, that is, internal pressure creep rupture test (hydrostatic resistance test) at 27 °C for 1 h/100 h, as applicable as per Table 7. The number of test samples selected from the lot for subjecting to these tests shall be in accordance with Table 9. The samples shall be selected randomly from the samples which have been already tested for and satisfied the requirements for visual and dimensional characteristics. The lot shall be considered to have met the requirements of these tests, if none of the samples tested fails.

Table 9 Scale of Sampling for Acceptance Tests Other than Visual and Dimensional Requirements

(*Clause* 9.2.4)

Sl No. (1)	No. of Pipes in the Lot (2)	Sample Size (3)
i)	Up to 150	3
ii)	151 to 1 200	5
iii)	1 201 to 35 000	8

9.2.4.2 *Fittings sizes including and above 630 mm*

For fittings sizes 630 mm and above, the sampling and criteria for conformity shall be as agreed between the purchaser and the manufacturer.

10 MARKING

10.1 All fittings shall be clearly and indelibly marked at a prominent place in white/yellow colour using ink/paint or inkjet print or hot embossed at minimum one place, visible even after the installation of the fittings, with the following information:

a) Manufacture's name/trade-mark;
b) Designation as per **5**;
c) Pressure rating;
d) Standard Dimension Ratio (SDR); and
e) Lot number/batch number, containing information of date of manufacture.

10.1.1 The lot number/batch number shall include the details of production in the following manner:

Year	Month	Day	Machine No.	Shift
xxxx	xx	xx	xxx	x

10.2 BIS Certification Marking

Fabricated PE fitting conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations framed thereunder, and each fabricated PE fitting may be marked with the Standard Mark.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Plastic Piping System Sectional Committee, CED 50

Organization	*Representative(s)*
Central Institute of Plastic Engineering and Technology, Chennai	Dr S. K. Nayak (***Chairman***)
Borouge India Pvt Ltd, Mumbai	Shri Prashant D. Nikhade
Brihan Mumbai Licensed Plumbers Association, Mumbai	Shri Kishor V. Merchant Shri Bijal M. Shah (*Alternate*)
Central Institute of Plastic Engineering and Technology, Chennai	Dr S. N. Yadav Shri D. Anjaneya Sharma (*Alternate*)
Central Public Health Environmental Engineering Organization, New Delhi	Adviser (PHE) Assistant Adviser (PHE) (*Alternate*)
Central Public Works Department, New Delhi	Shri M. K. Sharma Shri Amar Singh (*Alternate*)
Chennai Metropolitan Water Supply & Sewerage Board, Chennai	Engineering Director Superintending Engineer (P & D) (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Dr B. Singh Shri Rajiv Kumar (*Alternate*)
CSIR-National Environmental Engineering Research Institute, Nagpur	Dr (Shrimati) Abha Sargonkar Dr Ritesh Vijay (*Alternate*)
Delhi Development Authority, New Delhi	Superintending Engineer (D) Executive Engineer (R & D) (*Alternate*)
Delhi Jal Board, New Delhi	Shri Y. K. Sharma Shri S. L. Meena (*Alternate*)
Department of Chemical & Petrochemicals Govt of India, New Delhi	Joint Industrial Advisor
Finolex Industries Limited, Pune	Shri Arun Sonawane Shri D. J. Salunke (*Alternate*)
GAIL India Limited, New Delhi	Shri Manish Khandelwal Shri Kuldeep Negi (*Alternate*)
Government e-Marketplace, New Delhi	Representative
Haldia Petrochemicals Ltd, Kolkata	Shri Raj K. Datta Shri Amartya Maity (*Alternate*)
Indian Oil Corporation Ltd, Panipat	Shri Dhananjay Sahoo Shri Raja Poddar (*Alternate*)
Jain Irrigation System Limited, Jalgaon	Shri S. Narayanaswami Shri P. H. Chaudhari (*Alternate*)
Kolkata Municipal Corporation, Kolkata	Shri D. K. Sanyal Shri A. K. Biswas (*Alternate*)
Mahindra EPC Irrigation Ltd, Nashik	Shri Sankar Kumar Maiti Shri C. V. Joshi (*Alternate*)

Organization	*Representative(s)*
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NSF Safety and Certification India PvtLtd, Gurugram	Shri B. B. Singh Shri Nasrin Kashefi (*Alternate*)
Odisha PVC Pipes Manufacturing Association, Bhubaneswar	Shri Nikunj Chhotray
Panchayati Raj and Drinking Water Department, Govt of Odisha, Bhubaneswar	Chief Engineer
Plastindia Foundation, Mumbai	Shri Rajiv J. Raval Dr E. Sundaresan (*Alternate*)
Public Health Engineering Department, Jaipur	Superintending Engineer Executive Engineer (*Alternate*)
Reliance Industries Limited, Mumbai	Shri S. V. Raju Shri Saurabh Baghal (*Alternate*)
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Shaktiman Extrusions Pvt Ltd, Perumbavoor	Shri N. Suresh Shri T. S. Manoj (*Alternate*)
Supreme Industries Limited, Jalgaon	Shri G. K. Saxena
Tamil Nadu Water Supply & Drainage Board, Chennai	Engineering Director Joint Chief Engineer (COM) (*Alternate*)
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In Personal Capacity (*L-202 Metrozone, Anna Nagar West Chennai 600 040*)	Shri G. K. Srinivasan
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Scientist 'D' (Civil Engineering), BIS

Polyolefins and GRP Piping System Subcommittee, CED 50 : 1

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Central Public Works Department, New Delhi	Shri M. K. Sharma (CSQ) Shri Amar Singh (*Alternate*)
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Delhi Jal Board, New Delhi	Shri Y. K. Sharma Shri S. L. Meena (*Alternate*)
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Engineers India Ltd, New Delhi	Shri N. Kaul Shri R. B. Bhutda (*Alternate*)
EPP Composite Pipes, Rajkot	Shri Jayraj Shah Shrimati Seema Vaidya (*Alternate*)
GAIL India Limited, New Delhi	Dr Debasish Roy Shri Manish Khandelwal (*Alternate*)
Godavari Polymers Pvt Limited, Secunderabad	Shri C. Venkateshwar Rao Shri G. Sridhar Rao (*Alternate*)
Government E-Marketplace, New Delhi	Representative
Indraprastha Gas Limited, New Delhi	Representative
Industrial Toxicology Research Centre, Lucknow	Dr V. P. Sharma Dr Virendra Misra (*Alternate*)
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Kimplas Piping Systems Ltd, Nashik	Shri Kiran Sarode Shri Santosh Kumar (*Alternate*)
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Mahanagar Telephone Nigam Limited, New Delhi	Chief Engineer (BW)
Maruthi Tubes Pvt Ltd, Secunderabad	Shri Manchaala Raghavendra Shri M. Nagesh Kumar (*Alternate*)

Organization	*Representative(s)*
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Reliance Industries Limited, Mumbai	Shri S. V. Raju Shri Saurabh Baghal (*Alternate* I) Shri Tushar Dongre (*Alternate* II)
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Duraline India Pvt Ltd, Mumbai	Shri Rajeev Chaturvedi Shri Sunil Saxena (*Alternate*)
Godavari Polymers Pvt Ltd, Secunderabad	Shri C. Venkateshwar Rao
Haldia Petrochemicals Ltd, Kolkata	Shri Raj K. Datta Shri T. R. Srikanth (*Alternate*)
Jain Irrigation Systems Limited, Jalgaon	Shri M. R. Kharul
Reliance Industries, Mumbai	Shri S. V. Raju Shri Tushar Dongre (*Alternate*)
Supreme Industries Ltd, Jalgaon	Shri G. K. Saxena
In Personal Capacity (*H-23/01, Panchjyot Society, Sector 29, Vashi, Navi Mumbai 400 703*)	Shri V. K. Sharma

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This Indian Standard has been developed from Doc No.: CED 50 (13621).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower-1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
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Published by BIS, New Delhi